APPENDIX 6.5-A

Wildlife Habitat Models

Table of Contents

Tables

1.0 Introduction

Habitat suitability modelling is an approach and tool that can be used to predict the availability and distribution of habitat for a particular wildlife species or suite of species, and that can help to identify areas of higher quality habitat in a given landscape. This approach has been used extensively to document areas of important wildlife habitat and to predict the potential effects of habitat alteration on wildlife populations (Brooks 1997, Marzluff et al. 2002). Model results and mapping outputs are tools in the evaluation of land management because they help to quantify and display the distribution of habitat “quality” across a landscape. Using habitat suitability modelling is an accepted method of identifying habitat value and specific geographic locations as the basis of impact assessment and wildlife management.

Selected wildlife criteria are provincially and/or federally listed and/or of social/cultural importance, as well as being representative of the habitat requirements of other species (i.e., they limit the amount of assessment and ecological redundancy by capturing the habitat needs of a suite of species or represent reliance on a particular landscape feature of ecological significance, such as a wetland ecosystem). Wildlife criteria selected for habitat suitability modelling are, therefore, representative species that allow for a focused examination of the ways a project may result in changes to the environment in terms of issues of importance to the species and the habitats they use. A two-category habitat model (suitable/not suitable) was developed for bats (Little Brown Myotis [*Myotis lucifugus*], Northern Myotis [*Myotis keenii*]) following methods guided by the Ministry of Environment, Conservation and Parks; details are provided in Section 6.5.5. Habitat modelling was not conducted for gray wolf (*Canis lupus*) because they are habitat generalists capable of exploiting a variety of habitat types where there is sufficient ungulate prey.

2.0 Birds

Habitat suitability modelling was used to quantify habitat changes between the Project for the ten bird criteria selected for the Project (Table 2.0-1). Selected wildlife criteria are provincially and/or federally listed and/or of social/cultural importance, as well as being representative of the habitat requirements of other species (i.e., they limit the amount of assessment and ecological redundancy by capturing the habitat needs of a suite of species or represent reliance on a particular landscape feature of ecological significance, such as a wetland ecosystem). Wildlife criteria selected for habitat suitability modelling are, therefore, representative species that allow for a focused examination of the ways a project may result in changes to the environment in terms of issues of importance to the species and the habitats they use.

Table 2.0-1: Bird Criteria Habitat Suitability Models

Species	Season	Habitat Type
Bald Eagle	Breeding	Nesting habitat
Bank Swallow	Breeding	Nesting habitat
Barn Swallow	Breeding	Nesting habitat
Bobolink	Breeding	Nesting habitat
Canada Warbler	Breeding	Nesting habitat
Chimney Swift	Breeding	Nesting habitat
Common Nighthawk	Breeding	Nesting habitat
Eastern Whip-poor-will	Breeding	Nesting habitat
Eastern Wood-Pewee	Breeding	Nesting habitat
Olive-sided Flycatcher	Breeding	Nesting habitat

2.1 Bald Eagle

Bald eagles (*Haliaeetus leucocephalus*) in eastern Canada are short distance migrants that breed in eastern Canada in the summer and may migrate farther south for the winter (Wright 2016). The Project is located in breeding habitat for the bald eagle, and this habitat is the focus of this assessment. Bald eagles are found near major lakes or rivers (Buehler 2020) and perches within approximately 500 m of open water when foraging at or near the surface of the water (Buehler 2020). Shallow water and near-shore emergent vegetation increase the likelihood that live fish prey will be available near the surface (Buehler 2000, Armstrong 2014). Foraging area quality may also be higher in areas without human development and disturbance (Buehler 2000). One study found that of 817 bald eagle nest sites, 99% were found to be within 1.6 km of major shorelines (Stinson et al. 2007).

Moderate to high suitability bald eagle nesting habitat in the RSA was mapped as the following:

- Deciduous, coniferous, and mixed forest within 1.6 km of major waterbodies (i.e., greater than 300 ha), and watercourses >75 m wide; and
- Ecological Land Classification ecosites listed in Table 2.1-1 below, within 1.6 km of major waterbodies (i.e., greater than 300 ha), and watercourses >50 m wide.

Moderate to high suitability bald eagle winter roosting habitat is captured within the 2.6 km buffer of major waterbodies and rivers. In winter, bald eagles will congregate in night roosts that afford them protection from cold weather. These roosts are traditionally used for successive years and are located in mature forest in proximity to foraging habitat (Hall 1998).

Table 2.1-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Bald Eagle in the Regional Study Area

Ecosite	Description
B011	Very Shallow, Dry to Fresh: Red Pine - White Pine Conifer
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer
B013	Very Shallow, Dry to Fresh: Cedar - Hemlock Conifer
B014	Very Shallow. Dry to Fresh: Conifer
B015	Very Shallow, Dry to Fresh: Red Pine - White Pine Mixedwood
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood
B017	Very Shallow, Dry to Fresh: Oak Hardwood
B018	Very Shallow, Dry to Fresh: Maple Hardwood
B019	Very Shallow, Dry to Fresh: Mixedwood
B023	Very Shallow, Humid: Red Pine - White Pine Conifer
B024	Very Shallow, Humid: Black Spruce - Pine Conifer
B025	Very Shallow, Humid: Cedar - Hemlock Conifer
B026	Very Shallow, Humid: Conifer
B027	Very Shallow, Humid: Red Pine - White Pine Mixedwood
B028	Very Shallow, Humid: Mixedwood
B033	Dry, Sandy: Red Pine- White Pine Conifer
B034	Dry, Sandy: Jack Pine - Black Spruce Dominated
B035	Dry, Sandy: Pine - Black Spruce Conifer
B036	Dry, Sandy: Cedar - Hemlock Conifer
B037	Dry, Sandy: Spruce - Fir Conifer
B038	Dry, Sandy: Conifer
B039	Dry. Sandy: Red Pine - White Pine Mixedwood
B040	Dry, Sandy. Aspen - Birch Hardwood
B041	Dry, Sandy: Oak Hardwood
B042	Dry, Sandy: Maple Hardwood
B043	Dry, Sandy: Mixedwood

Ecosite	Description
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer
B051	Dry to Fresh, Coarse: Cedar - Hemlock Conifer
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer
B053	Dry to Fresh, Coarse: Conifer
B054	Dry to Fresh, Coarse: Red Pine - White Pine Mixedwood
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood
B057	Dry to Fresh, Coarse: Oak Hardwood
B058	Dry to Fresh, Coarse: Maple Hardwood
B059	Dry to Fresh, Coarse: Mixedwood
B064	Moist, Coarse: Red Pine - White Pine Conifer
B065	Moist, Coarse: Pine - Black Spruce Conifer
B066	Moist, Coarse: Hemlock - Cedar Conifer
B067	Moist, Coarse: Spruce - Fir Conifer
B068	Moist, Coarse: Conifer
B069	Moist, Coarse: Red Pine - White Pine Mixedwood
B070	Moist, Coarse: Aspen - Birch Hardwood
B071	Moist, Coarse: Elm - Ash Hardwood
B072	Moist, Coarse: Oak Hardwood
B073	Moist, Coarse: Sugar Maple Hardwood
B074	Moist, Coarse: Red Maple Hardwood
B075	Moist, Coarse: Maple Hardwood
B076	Moist, Coarse: Mixedwood
B081	Fresh, Clayey: Red Pine - White Pine Conifer
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated
B083	Fresh, Clayey: Pine - Black Spruce Conifer
B084	Fresh, Clayey: Hemlock - Cedar Conifer
B085	Fresh, Clayey: Spruce - Fir Conifer
B086	Fresh, Clayey: Conifer
B087	Fresh, Clayey: Red Pine - White Pine Mixedwood
B088	Fresh, Clayey: Aspen - Birch Hardwood
B089	Fresh, Clayey: Elm - Ash Hardwood
B090	Fresh, Clayey: Oak Hardwood
B091	Fresh, Clayey: Maple Hardwood
B092	Fresh, Clayey: Mixedwood
B097	Fresh, Silty to Fine Loamy: Red Pine - White Pine Conifer
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Dominated

Ecosite	Description
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce Conifer
B100	Fresh, Silty to Fine Loamy: Hemlock - Cedar Conifer
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer
B102	Fresh, Silty to Fine Loamy: Conifer
B103	Fresh, Silty to Fine Loamy: Red Pine - White Pine Mixedwood
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood
B105	Fresh, Silty to Fine Loamy: Elm - Ash Hardwood
B106	Fresh, Silty to Fine Loamy: Oak Hardwood
B107	Fresh, Silty to Fine Loamy: Maple Hardwood
B108	Fresh, Silty to Fine Loamy: Mixedwood
B113	Moist, Fine: White Pine Conifer
B114	Moist, Fine: Pine - Black Spruce Conifer
B115	Moist, Fine: Hemlock - Cedar Conifer
B116	Moist Fine: Spruce - Fir Conifer
B117	Moist, Fine: Conifer
B118	Moist, Fine: White Pine Mixedwood
B119	Moist, Fine: Aspen - Birch Hardwood
B120	Moist Fine: Elm - Ash Hardwood
B121	Moist, Fine: Oak Hardwood
B122	Moist Fine: Sugar Maple Hardwood
B123	Moist. Fine: Red Maple Hardwood
B124	Moist. Fine: Maple Hardwood
B125	Moist. Fine: Mixedwood
B222	Mineral Poor Conifer Swamp
B223	Mineral Intermediate Conifer Swamp
B224	Mineral Rich Conifer Swamp

2.2 Bank Swallow

In Ontario, the highest abundance of bank swallow (*Riparia riparia*) is found in the Carolinian ecozone, while significant populations are also present and occur along some of the large rivers in the Hudson Bay Lowlands, including the Albany River (Cadman et al. 2007). Within northwestern Ontario, the species is found primarily at aggregate pits (Cadman et al. 2007).

Bank swallows nest colonially in soft substrates; naturally they nest along the shoreline banks of large watercourses, while in anthropogenic sites they typically nest in sand and gravel pits, along roadsides, and in soil stockpiles (Garrison and Turner 2020).

Moderate to high suitability bank swallow nesting habitat in the RSA was mapped as the following:

- All aggregate pits within the RSA and a buffer of 500 m around each site;
- The ecosite Excavated Bluff (B01), per the Ecological Land Classification system; and
- The *General Habitat Description for the Bank Swallow (Riparia riparia)* (MNRF 2015) surrounding active nesting colonies, following observations made by WSP. The Ontario Ministry of Natural Resources and Forestry (MNRF 2015) classified habitat into three categories:
  - Category 1: the bank swallow breeding colony, including the congregation of burrows and the substrate between and around them;
  - Category 2: the area within 50 m in front of the breeding colony bank face to allow bank swallows to enter and exit burrows; and
  - Category 3: the area of suitable foraging habitat within 500 m of the outer edge of the breeding colony.

2.3 Barn Swallow

In Ontario, barn swallow is found throughout the province in close proximity to human settlements and agriculture operations (Cadman et al. 2007). The highest population abundances are found in the Carolinian and Great Lakes – St. Lawrence ecoregions (Cadman et al. 2007).

Barn swallows nest on artificial structures, such as buildings and bridges, where they fasten mud nests to vertical walls in proximity to open habitat for foraging (COSEWIC 2021). Barn swallows rely on open areas like pastureland for foraging, with meadows and fields in proximity to agricultural operations being especially important to the species (Brown and Brown 2020).

Moderate to high suitability barn swallow nesting and foraging habitat in the RSA was mapped as the following:

- All bridges within the RSA for breeding and a buffer of 200 m around each site; and
- Ecological Land Classification ecosites listed in Table 2.3-1, below, for foraging habitats.

Table 2.3-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Foraging Barn Swallow in the Regional Study Area

Ecosite	Description
B020	Very Shallow, Humid: Meadow
B029	Dry, Sandy. Field
B030	Dry, Sandy. Meadow
B044	Dry to Fresh, Coarse: Field
B045	Dry to Fresh, Coarse: Meadow
B060	Moist, Coarse: Field
B061	Moist, Coarse: Meadow
B077	Fresh, Clayey: Field
B078	Fresh, Clayey: Meadow
B093	Fresh, Silty to Fine Loamy: Field
B094	Fresh, Silty to Fine Loamy: Meadow
B109	Moist, Fine: Field
B110	Moist, Fine: Meadow

2.4 Bobolink

Bobolink (*Dolichonyx oryzivorus*) inhabits Canada's grassland and agricultural areas from the interior of British Columbia to the east coast. Within Ontario, the bobolink is found widely throughout southern Ontario (Cadman et al. 2007). In northern Ontario, the species is found in several small patches of distribution, primarily centred around agricultural areas (Cadman et al. 2007).

Bobolinks depend on grassland habitat which includes hayfields, pastures, old or abandoned fields, and remnant prairies and savannahs (COSEWIC 2010). Minimum area requirements to support breeding habitat for the species have been reported to range from 5 to 30 ha (McCracken et al. 2013). Many studies have demonstrated that bobolink require grassy patches much larger than their territory size to persist (Renfrew et al. 2020).

Ecological Land Classification data were used to determine suitable bobolink habitat and the ecosites are outlined in Table 2.4-1, below.

Table 2.4-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Bobolink in the Regional Study Area

Ecosite	Description
B008	Very Shallow, Dry to Fresh: Meadow
B020	Very Shallow, Humid: Meadow
B029	Dry, Sandy. Field
B030	Dry, Sandy. Meadow
B044	Dry to Fresh, Coarse: Field

Ecosite	Description
B045	Dry to Fresh, Coarse: Meadow
B060	Moist, Coarse: Field
B061	Moist, Coarse: Meadow
B077	Fresh, Clayey: Field
B078	Fresh, Clayey: Meadow
B093	Fresh, Silty to Fine Loamy: Field
B094	Fresh, Silty to Fine Loamy: Meadow
B109	Moist, Fine: Field
B110	Moist, Fine: Meadow

2.5 Canada Warbler

Throughout their range, Canada warblers (*Cardellina canadensis*) nest in a range of usually wet, forest types, with a well-developed, dense shrub layer (COSEWIC 2008, Environment Canada 2015). This species is commonly found in shrub thickets, swamps, mixed and deciduous forest and riparian woodlands (COSEWIC 2008). In the eastern portion of their range, which includes the RSA, Canada warblers are associated with wet mixedwood forests and early successional forests created by forest harvesting or natural disturbance (Ball and Bayne 2014, Environment Canada 2015).

Ecological Land Classification data were used to determine suitable Canada warbler habitat and the ecosites are outlined in Table 2.5-1, below

Table 2.5-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Canada Warbler in the Regional Study Area

Ecosite	Description
B009	Very Shallow, Dry to Fresh: Sparse Shrub
B010	Very Shallow, Dry to Fresh: Shrub
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood
B017	Very Shallow, Dry to Fresh: Oak Hardwood
B018	Very Shallow, Dry to Fresh: Maple Hardwood
B019	Very Shallow, Dry to Fresh: Mixedwood
B021	Very Shallow, Humid: Sparse Shrub
B022	Very Shallow, Humid: Shrub
B023	Very Shallow, Humid: Red Pine - White Pine Conifer
B024	Very Shallow, Humid: Black Spruce - Pine Conifer
B025	Very Shallow, Humid: Cedar - Hemlock Conifer
B026	Very Shallow, Humid: Conifer
B027	Very Shallow, Humid: Red Pine - White Pine Mixedwood
B028	Very Shallow, Humid: Mixedwood

Ecosite	Description
B031	Dry, Sandy: Sparse Shrub
B032	Dry, Sandy: Shrub
B040	Dry, Sandy. Aspen - Birch Hardwood
B041	Dry, Sandy: Oak Hardwood
B042	Dry, Sandy: Maple Hardwood
B043	Dry, Sandy: Mixedwood
B046	Dry to Fresh, Coarse: Sparse Shrub
B047	Dry to Fresh, Coarse: Shrub
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood
B057	Dry to Fresh, Coarse: Oak Hardwood
B058	Dry to Fresh, Coarse: Maple Hardwood
B059	Dry to Fresh, Coarse: Mixedwood
B062	Moist, Coarse: Sparse Shrub
B063	Moist, Coarse: Shrub
B070	Moist, Coarse: Aspen - Birch Hardwood
B071	Moist, Coarse: Elm - Ash Hardwood
B072	Moist, Coarse: Oak Hardwood
B073	Moist, Coarse: Sugar Maple Hardwood
B074	Moist, Coarse: Red Maple Hardwood
B075	Moist, Coarse: Maple Hardwood
B076	Moist, Coarse: Mixedwood
B079	Fresh, Clayey: Sparse Shrub
B080	Fresh, Clayey: Shrub
B088	Fresh, Clayey: Aspen - Birch Hardwood
B089	Fresh, Clayey: Elm - Ash Hardwood
B090	Fresh, Clayey: Oak Hardwood
B091	Fresh, Clayey: Maple Hardwood
B092	Fresh, Clayey: Mixedwood
B095	Fresh, Silty to Fine Loamy: Sparse Shrub
B096	Fresh, Silty to Fine Loamy: Shrub
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood
B105	Fresh, Silty to Fine Loamy: Elm - Ash Hardwood
B106	Fresh, Silty to Fine Loamy: Oak Hardwood
B107	Fresh, Silty to Fine Loamy: Maple Hardwood
B108	Fresh, Silty to Fine Loamy: Mixedwood
B111	Moist, Fine: Sparse Shrub
B112	Moist. Fine: Shrub
B118	Moist, Fine: White Pine Mixedwood

Ecosite	Description
B119	Moist, Fine: Aspen - Birch Hardwood
B120	Moist Fine: Elm - Ash Hardwood
B121	Moist, Fine: Oak Hardwood
B122	Moist Fine: Sugar Maple Hardwood
B123	Moist. Fine: Red Maple Hardwood
B124	Moist. Fine: Maple Hardwood
B125	Moist. Fine: Mixedwood
B127	Poor Conifer Swamp
B128	Intermediate Conifer Swamp
B129	Rich Conifer Swamp
B130	Intolerant Hardwood Swamp
B131	Maple Hardwood Swamp
B132	Oak Hardwood Swamp
B133	Hardwood Swamp
B134	Mineral Thicket Swamp
B135	Organic Thicket Swamp

2.6 Chimney Swift

The chimney swift breeds across eastern North America as far north as central Saskatchewan (COSEWIC 2018). In Ontario, the species is found predominantly in the Carolinian and southern Shield regions; however, the species has been found nesting sporadically as far north as the 49th parallel (Cadman et al. 2007).

Before European settlement, chimney swifts primarily nested on cave walls and in cavities within large trees (Steeves et al. 2020). Today, chimney swifts primarily nest in anthropogenic locations, where they nest and roost in the chimneys of man-made structures and buildings (Cadman et al. 2007, Steeves et al. 2020).

Moderate to high suitability chimney swift nesting habitat in the RSA was mapped as the following:

- Urban settlements within the RSA, where suitable nesting sites have the potential to be present.

2.7 Common Nighthawk

Common nighthawks (*Chordeiles minor*) breed in open habitats, such as recently logged and burned areas, open forests, open bogs and fens, and rock barrens (COSEWIC 2007a, Brigham et al. 2011). Nesting areas are chosen in association with large trees for roosting and vegetation for the production of flying insect prey (Brigham et al. 2011). This species avoids areas of dense, intact forest (Brigham et al. 2011).

Moderate to high suitability for common nighthawk nesting habitat in the RSA was mapped as the following:

- ELC data were used to determine suitable common nighthawk habitat and the ecosites are outlined in Table 2.7-1, below.
- The following edge areas: 50 m into coniferous, deciduous, and mixed forest ELC ecosites that border one or more of the following:
  - Water;
  - burns aged 0 to 10 years;
  - Sand Dune;
  - Barren;
  - Meadow;
  - Field;
  - Rock Barren; and
  - Raised Beach.
- Recently logged forest (aged 0 to 10 years).
- Recently burned areas (aged 0 to 10 years).

Table 2.7-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Common Nighthawk in the Regional Study Area

Ecosite	Description
B006	Active Sand Dune
B007	Active Mineral Barren
B008	Very Shallow, Dry to Fresh: Meadow
B030	Dry, Sandy. Meadow
B044	Dry to Fresh, Coarse: Field
B045	Dry to Fresh, Coarse: Meadow
B060	Moist, Coarse: Field
B061	Moist, Coarse: Meadow

Ecosite	Description
B077	Fresh, Clayey: Field
B078	Fresh, Clayey: Meadow
B093	Fresh, Silty to Fine Loamy: Field
B094	Fresh, Silty to Fine Loamy: Meadow
B109	Moist, Fine: Field
B110	Moist, Fine: Meadow
B163	Active Rock Barren
B164	Rock Barren
B165	Open Rock Barren
B166	Active Talus or Historic/Raised Beach
B167	Talus or Historic/Raised Beach
B168	Open Talus or Historic/Raised Beach
B179	Calcareous Active Rock Barren
B180	Calcareous Rock Barren
B181	Calcareous Open Rock Barren
B215	Coastal Mineral Barren

2.8 Eastern Whip-poor-will

Eastern whip-poor-wills (*Caprimulgus vociferus*) breed in semi-open or patchy forests; wide-open spaces and dense forests are avoided (COSEWIC 2009). Forest structure seems to be more important than forest composition, but Eastern whip-poor-wills are found in dry deciduous or mixedwood forests throughout most of the species' range (Cink 2002). Eastern whip-poor-wills are also commonly found in rock or sand barrens with scattered trees, old burns, other disturbed sites with early forest succession, and pine plantations (Cink 2002, COSEWIC 2009). This species prefers even-aged successional habitats and is uncommon in mature forests, although individuals may use openings in mature forest areas (Bushman and Therres 1988, Government of Ontario 2015a). Nests require tree cover, shade, and sparse ground cover, and they need to be in close proximity to open areas used for foraging (MNR 2013). Transmission line rights-of-way (ROWs) and road corridors may provide suitable foraging habitat for this species (COSEWIC 2009).

Suitable Eastern whip-poor-will habitat was mapped using the following Ecological Land Classification ecosites, outlined under Table 2.8-1, below, that met one of the following two criteria:

- Stands, aged 10-40 years with dense forest cover (but sparse to moderate understory), within 30 m of open areas (where spare to moderate forest cover is <75%); or
- Stands, aged 10-30 years with sparse to moderate forest cover (and sparse to moderate understory) (where sparse to moderate understory is <50%).

Suitable Eastern whip-poor-will habitat was also mapped using open areas with Forest Resource Inventory (FRI) data, including the following aggregates:

- Developed Agricultural Land (DAL);
- Grass and Meadow (GRS);
- Small Island (ISL);
- Unclassified (UCL);
- Brush and Alder (BHS);
- Open Wetland (OMS); and
- Rock (RCK).

Positive observations of Eastern whip-poor-wills made by WSP were additionally mapped, following the *General Habitat Description for the Eastern Whip-poor-will (Caprimulgus vociferus)* (MNRF 2015). The Ontario Ministry of Natural Resources and Forestry (MNRF 2015) classified habitat into three categories:

- Category 1: nest and the area within 20 m of the nest;
- Category 2: the area between 20 m and 170 m from the nest or centre of approximated defended territory; and
- Category 3: the area of suitable habitat between 170 m and 500 m of the nest or centre of approximated defended territory.

Table 2.8-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Eastern Whip-poor-will in the Regional Study Area

Ecosite	Habitat Description
B011	Very Shallow, Dry to Fresh: Red Pine - White Pine Conifer
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer
B013	Very Shallow, Dry to Fresh: Cedar - Hemlock Conifer
B014	Very Shallow. Dry to Fresh: Conifer
B015	Very Shallow, Dry to Fresh: Red Pine - White Pine Mixedwood
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood
B017	Very Shallow, Dry to Fresh: Oak Hardwood
B018	Very Shallow, Dry to Fresh: Maple Hardwood
B019	Very Shallow, Dry to Fresh: Mixedwood
B033	Dry, Sandy: Red Pine- White Pine Conifer
B034	Dry, Sandy: Jack Pine - Black Spruce Dominated
B035	Dry, Sandy: Pine - Black Spruce Conifer

Ecosite	Habitat Description
B036	Dry, Sandy: Cedar - Hemlock Conifer
B037	Dry, Sandy: Spruce - Fir Conifer
B038	Dry, Sandy: Conifer
B039	Dry. Sandy: Red Pine - White Pine Mixedwood
B040	Dry, Sandy. Aspen - Birch Hardwood
B041	Dry, Sandy: Oak Hardwood
B042	Dry, Sandy: Maple Hardwood
B043	Dry, Sandy: Mixedwood
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer
B051	Dry to Fresh, Coarse: Cedar - Hemlock Conifer
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer
B053	Dry to Fresh, Coarse: Conifer
B054	Dry to Fresh, Coarse: Red Pine - White Pine Mixedwood
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood
B057	Dry to Fresh, Coarse: Oak Hardwood
B058	Dry to Fresh, Coarse: Maple Hardwood
B059	Dry to Fresh, Coarse: Mixedwood

2.9 Eastern Wood-Pewee

The breeding range in Canada includes all provinces east of Alberta, except Newfoundland and Labrador, while the population stronghold is in Ontario (COSEWIC 2012). In Ontario, the species occurs throughout the province and its highest abundances are located throughout the Great Lakes – St. Lawrence ecozones (Cadman et al. 2007).

Eastern wood-pewee is often associated with forest clearings and edges and has been recorded breeding in both deciduous and coniferous habitats (Watt et al. 2020); however, in Ontario, Eastern Wood-Pewee is most typically associated with rich deciduous forest (Cadman et al. 2007, COSEWIC 2012).

Ecological Land Classification data were used to determine suitable Eastern wood-pewee habitat and the ecosites are outlined in Table 2.9-1, below.

Table 2.9-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Eastern Wood-Pewee in the Regional Study Area

Ecosite	Description
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood

Ecosite	Description
B017	Very Shallow, Dry to Fresh: Oak Hardwood
B018	Very Shallow, Dry to Fresh: Maple Hardwood
B019	Very Shallow, Dry to Fresh: Mixedwood
B023	Very Shallow, Humid: Red Pine - White Pine Conifer
B024	Very Shallow, Humid: Black Spruce - Pine Conifer
B025	Very Shallow, Humid: Cedar - Hemlock Conifer
B026	Very Shallow, Humid: Conifer
B027	Very Shallow, Humid: Red Pine - White Pine Mixedwood
B028	Very Shallow, Humid: Mixedwood
B040	Dry, Sandy. Aspen - Birch Hardwood
B041	Dry, Sandy: Oak Hardwood
B042	Dry, Sandy: Maple Hardwood
B043	Dry, Sandy: Mixedwood
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood
B057	Dry to Fresh, Coarse: Oak Hardwood
B058	Dry to Fresh, Coarse: Maple Hardwood
B059	Dry to Fresh, Coarse: Mixedwood
B070	Moist, Coarse: Aspen - Birch Hardwood
B071	Moist, Coarse: Elm - Ash Hardwood
B072	Moist, Coarse: Oak Hardwood
B073	Moist, Coarse: Sugar Maple Hardwood
B074	Moist, Coarse: Red Maple Hardwood
B075	Moist, Coarse: Maple Hardwood
B076	Moist, Coarse: Mixedwood
B088	Fresh, Clayey: Aspen - Birch Hardwood
B089	Fresh, Clayey: Elm - Ash Hardwood
B090	Fresh, Clayey: Oak Hardwood
B091	Fresh, Clayey: Maple Hardwood
B092	Fresh, Clayey: Mixedwood
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood
B105	Fresh, Silty to Fine Loamy: Elm - Ash Hardwood
B106	Fresh, Silty to Fine Loamy: Oak Hardwood
B107	Fresh, Silty to Fine Loamy: Maple Hardwood
B108	Fresh, Silty to Fine Loamy: Mixedwood
B118	Moist, Fine: White Pine Mixedwood
B119	Moist, Fine: Aspen - Birch Hardwood
B120	Moist Fine: Elm - Ash Hardwood
B121	Moist, Fine: Oak Hardwood

Ecosite	Description
B122	Moist Fine: Sugar Maple Hardwood
B123	Moist. Fine: Red Maple Hardwood
B124	Moist. Fine: Maple Hardwood
B125	Moist. Fine: Mixedwood
B130	Intolerant Hardwood Swamp
B131	Maple Hardwood Swamp
B132	Oak Hardwood Swamp
B133	Hardwood Swamp
B134	Mineral Thicket Swamp
B135	Organic Thicket Swamp

2.10 Trumpeter Swan

In Ontario, the species occurs throughout the province in distinct regions, centred in northwestern Ontario, south-central Ontario, Sault Ste. Marie, and southeastern Ontario (Cadman et al. 2007) and its highest abundances are located within the south-central portion of the province (Thomas et al. 2021).

Trumpeter swans are found in association with marsh habitats (e.g., freshwater marshes, ponds, beaver ponds, bogs) (Mitchell and Eichholz 2020). Key parameters for nesting habitat for the species include room for take-off (~100 m), accessible forage locations, stable water levels, emergent vegetation, the presence of muskrat or beaves houses, or other structures for nest sites, and low human disturbance (Mitchell and Eichholz 2020).

Moderate to high suitability for trumpeter swan nesting habitat in the RSA was mapped as the following:

- ELC data were used to determine suitable trumpeter swan habitat and the ecosites are outlined in Table 2.10-1, below, where the ecosite is adjacent to a water feature.
  - All terrestrial edge areas that border an ecosite outlined in Table 9, up to 100 m.
  - All aquatic edge areas that border an ecosite outlined in Table 9, up to 1,000 m.
- Beaver ponds and adjacent lands up to 100 m in terrestrial habitats and up to 1,000 m in aquatic habitats.

Table 2.10-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Trumpeter Swan in the Regional Study Area

Ecosite	Description
B136	Sparse Treed Fen
B137	Sparse Treed Bog
B138	Open Bog

Ecosite	Description
B139	Poor Fen
B140	Open Moderately Rich Fen
B141	Open Extremely Rich Fen
B142	Mineral Meadow Marsh
B143	Rock Meadow Marsh
B144	Organic Meadow Marsh
B145	Floating Marsh
B146	Open Shore Fen
B147	Shrub Shore Fen
B148	Mineral Shallow Marsh
B149	Organic Shallow Marsh
B150	Open Water Marsh: Floating-leaved
B151	Open Water Marsh: Mineral
B152	Open Water Marsh: Organic

2.11 Olive-sided Flycatcher

Olive-sided flycatchers (*Contopus cooperi*) breed in forested areas in Canada and parts of the United States and overwinter in central and south America. The Project is located in breeding habitat for this species. Olive-sided flycatchers prefer tall trees and snags adjacent to open areas, which provide individuals with perches from which to hunt flying insects. Olive-sided flycatchers nest in forested stands, but because of their foraging behaviour, are associated with high contrast habitats including burned forests, logged areas, and natural forest openings, such as gaps within old growth forest stands, as well as meadows, rivers, and wetlands adjacent to forested habitat (COSEWIC 2007b, Altman and Sallabanks 2012). As a result, their abundance is correlated with landscapes containing fragmented lateseral forest with high contrast edges, mature trees and large numbers of dead trees (McGarigal and McComb 1995, Altman and Sallabanks 2012). In Ontario, olive-sided flycatchers commonly nest in conifers such as white and black spruce, jack pine and balsam fir (Government of Ontario 2015b).

Ecological Land Classification data were used to determine suitable olive-sided flycatcher habitat and the ecosites are outlined in Table 2.11-1, below.

Table 2.11-1: Ecological Land Classification Ecosites Identified as Moderate to High Suitability for Breeding Olive-sided Flycatcher in the Regional Study Area

Ecosite	Description
B011	Very Shallow, Dry to Fresh: Red Pine - White Pine Conifer
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer
B013	Very Shallow, Dry to Fresh: Cedar - Hemlock Conifer
B014	Very Shallow. Dry to Fresh: Conifer
B015	Very Shallow, Dry to Fresh: Red Pine - White Pine Mixedwood

Ecosite	Description
B019	Very Shallow, Dry to Fresh: Mixedwood
B023	Very Shallow, Humid: Red Pine - White Pine Conifer
B024	Very Shallow, Humid: Black Spruce - Pine Conifer
B025	Very Shallow, Humid: Cedar - Hemlock Conifer
B026	Very Shallow, Humid: Conifer
B027	Very Shallow, Humid: Red Pine - White Pine Mixedwood
B028	Very Shallow, Humid: Mixedwood
B033	Dry, Sandy: Red Pine- White Pine Conifer
B034	Dry, Sandy: Jack Pine - Black Spruce Dominated
B035	Dry, Sandy: Pine - Black Spruce Conifer
B036	Dry, Sandy: Cedar - Hemlock Conifer
B037	Dry, Sandy: Spruce - Fir Conifer
B038	Dry, Sandy: Conifer
B039	Dry. Sandy: Red Pine - White Pine Mixedwood
B043	Dry, Sandy: Mixedwood
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer
B051	Dry to Fresh, Coarse: Cedar - Hemlock Conifer
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer
B053	Dry to Fresh, Coarse: Conifer
B054	Dry to Fresh, Coarse: Red Pine - White Pine Mixedwood
B059	Dry to Fresh, Coarse: Mixedwood
B064	Moist, Coarse: Red Pine - White Pine Conifer
B065	Moist, Coarse: Pine - Black Spruce Conifer
B066	Moist, Coarse: Hemlock - Cedar Conifer
B067	Moist, Coarse: Spruce - Fir Conifer
B068	Moist, Coarse: Conifer
B069	Moist, Coarse: Red Pine - White Pine Mixedwood
B076	Moist, Coarse: Mixedwood
B081	Fresh, Clayey: Red Pine - White Pine Conifer
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated
B083	Fresh, Clayey: Pine - Black Spruce Conifer
B084	Fresh, Clayey: Hemlock - Cedar Conifer
B085	Fresh, Clayey: Spruce - Fir Conifer
B086	Fresh, Clayey: Conifer
B087	Fresh, Clayey: Red Pine - White Pine Mixedwood
B092	Fresh, Clayey: Mixedwood
B097	Fresh, Silty to Fine Loamy: Red Pine - White Pine Conifer

Ecosite	Description
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Dominated
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce Conifer
B100	Fresh, Silty to Fine Loamy: Hemlock - Cedar Conifer
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer
B102	Fresh, Silty to Fine Loamy: Conifer
B103	Fresh, Silty to Fine Loamy: Red Pine - White Pine Mixedwood
B108	Fresh, Silty to Fine Loamy: Mixedwood
B113	Moist, Fine: White Pine Conifer
B114	Moist, Fine: Pine - Black Spruce Conifer
B115	Moist, Fine: Hemlock - Cedar Conifer
B116	Moist Fine: Spruce - Fir Conifer
B117	Moist, Fine: Conifer
B118	Moist, Fine: White Pine Mixedwood
B125	Moist. Fine: Mixedwood
B126	Treed Bog
B127	Poor Conifer Swamp
B128	Intermediate Conifer Swamp
B129	Rich Conifer Swamp
B134	Mineral Thicket Swamp
B135	Organic Thicket Swamp
B136	Sparse Treed Fen
B137	Sparse Treed Bog
B138	Open Bog
B139	Poor Fen
B140	Open Moderately Rich Fen
B141	Open Extremely Rich Fen
B146	Open Shore Fen
B222	Mineral Poor Conifer Swamp
B223	Mineral Intermediate Conifer Swamp
B224	Mineral Rich Conifer Swamp

3.0 Moose

3.1 Habitat Requirements and Predicted Suitability

Moose are considered a generalist species, but show preference for deciduous aspen, shrubland, and wetlands interspersed with trees and shrubs, particularly early successional forests (Street et al. 2015a). Moose prefer dense stands with greater than 60% coniferous species and trees greater than 10 m in height because these areas provide maximum thermal protection and lower snow depths (Allen et al. 1987). While aquatic habitat is used by moose in the warmer months, habitat containing deciduous foliage is more consistently linked to moose population abundance and species preference in the winter (Street et al. 2015b), except when deep snow (> 65 cm) is present (Peek et al. 1982).

During the winter, moose feed almost exclusively on twigs and branches of woody plants such as trembling aspen (*Populus tremuloides*), willow species (*Salix* spp.), red-osier dogwood (*Cornus sericea*), balsam poplar (*Populus balsamifera)*, alder species (*Alnus* spp.), and beaked hazelnut (*Corylus cornuta*) (OMNR 1988; Romito et al. 1999). During spring, summer, and fall, moose prefer to browse on shrubs, primarily consuming fresh shoots and leaves from deciduous shrubs and young deciduous trees (e.g., birch species [*Betula* spp.]; Wam and Hjeljord 2010). Aquatic vegetation (e.g., yellow pond lily [*Nuphar variegata*]) is important in the moose diet during the spring and summer months as these plants contain sodium and other nutrients not found in other items in their diet (OMNR 1988).

Forest fire disturbance increases the abundance of deciduous habitat by regenerating the landscape to an early successional stage where the forest canopy is reduced, allowing for regeneration of the deciduous understory shrubs and forbs (Street et al. 2015b). In upland habitats, functional habitat for moose is expected to become available 6 to 10 years after fire disturbance (i.e., after the development of a shrub layer) and resulting optimal moose habitat occurs at 10 to 26 years post-fire, with subsequent declines in moose population density occurring as tree stands mature (Nelson et al. 2008).

Habitat suitability rankings of landcover types and ecosites for moose in the terrestrial local study area (LSA) and moose regional study area (RSA) were assigned based on the habitat associations described in Table 3.1-1. The model incorporated seasonal requirements, movements, and use of habitats, such as the overall annual preference for deciduous and shrubby wetlands, periodic spring/summer use of more open aquatic habitats, and use of mature coniferous stands during deep snow conditions. Anthropogenic disturbances were considered in the model depending on the type of disturbance. Moose have been shown to avoid human disturbance such as clearings caused by agricultural activity (e.g., Mytton and Keith 1981). However, moose also prefer logged areas 10 to 30 years of age (Poole and Stuart-Smith 2004); thus, age of logged areas and burns were considered in the categorization of high, moderate and low suitability (Table 3.1-1). Low-impact disturbances, including cutlines, seismic lines, trails and existing ROWs, were classified as low suitability because moose have been

documented showing a preference for seismic lines and utility lines, and logging roads, (Higgelke 1994; Serrouya and D'Eon 2002). Access roads were classified as poor suitability, but no buffer was added because it is assumed that these roads had lower activity compared to highways. Research has demonstrated that moose may be drawn to salt on and around highways in winter (Miller and Litvaitis 1992), making it a higher mortality risk. Laurian et al. (2008) found that moose showed avoidance of areas up to 500 m from highways, and that highway and forest road crossing frequencies were 16 and 10 times lower than expected by chance, respectively. In a subsequent study, moose avoidance of roads varied seasonally from 100 m to 250 m (Laurian et al. 2012). Suitable habitats within 500 m of high-impact disturbances (i.e., highways and built-up residential, commercial and industrial areas) were assigned a suitability rank of poor based on scientific knowledge and as a precautionary approach.

Table 3.1-1: Landcover Types and Moose Habitat Suitability in the Regional Study Area

Landcover type[(a)]	Ecosite code[(b)]	Moose Suitability
Deciduous forest: 0-80 years old	B016,B017,B018','B040','B041','B042','B055','B056','B057','B058','B070','B071','B072','B073','B074','B075','B088','B089','B090','B091','B104','B105','B106','B107','B119','B120','B121','B122, B123, B124	High
Intermediate mixed forest: 6-20 years old	B015,B019','B027','B028','B039','B043','B054','B059','B069','B076','B087','B092','B103','B108','B118','B125	High
Intermediate coniferous forest: 6-20 years old	B011','B012','B013','B014','B023','B024','B025','B026','B033','B034','B035','B036','B037','B038','B048','B049','B050','B051','B052','B053','B064','B065','B066','B067','B068','B081','B082','B083','B084','B085','B086','B097','B098','B099','B100','B101','B102','B113','B114','B115','B116','B117	High
Treed wetland	POLYTYPE = TMS	High
Shrubby (willow) wetland	'B126','B127','B128','B129','B130','B131','B132','B133','B134','B135','B136','B137','B215','B221','B222','B223'	High
Burns: 6-20 years old	Fire Year = 2001-2015	High
Logged areas: 6-20 years old	Harvest Year = 1996 - 2010	High
Graminoid wetland	'B138','B139','B140','B141','B142','B143','B144','B145','B146','B147','B148','B149','B150','B151','B152','B216','B217','B218','B219','B220'	Moderate
Open wetland	POLYTYPE = OMS	Moderate
Mature mixed forest: 21-40 years old	B015','B019','B027','B028','B039','B043','B054','B059','B069','B076','B087','B092','B103','B108','B118','B125	Moderate

Landcover type[a]	Ecosite code[b]	Moose Suitability
Mature coniferous forest: 21-40 years old	B011','B012','B013','B014','B023','B024','B025','B026','B033','B034','B035','B036','B037','B038','B048','B049','B050','B051','B052','B053','B064','B065','B066','B067','B068','B081','B082','B083','B084','B085','B086','B097','B098','B099','B100','B101','B102','B113','B114','B115','B116','B117	Moderate
Burns: 21-40 years old	Fire Year = 1981-2000	Moderate
Logged areas: 21-40 years old	Harvest Year = 1976-1995	Moderate
Meadow, field	'B044','B060','B093','B008','B030','B078','B094','B110', 'B109','B061'	Low
Old forest: >40 years old	FOR AGE >=41	Low
Burns: 0-5 years old	Fire Year = 2016-2021	Low
Burns: >41 years old	Fire Year = <=1980	Low
Logged areas: 0-5 years old	Harvest Year = 2011-2016	Low
Logged areas: >41 years old	Harvest Year = <=1975	Low
Low impact existing disturbances	Cutlines, seismic lines, existing ROWs, trails.	Low
Shore	'B005','B006','B161','B171','B162','B172','B168','B167'	Poor
Bedrock	'B007','B004','B158','B001','B165','B159','B164'	Poor
Open water	POLYTYPE = WAT	Poor
Existing disturbances	Access roads	Poor
High impact existing disturbances	Residential, commercial, industrial, highways. Add 500 m buffer for zone of influence.	Poor

a) The summary of age of forests classes was derived from 'Overstory of Origin' metadata from the FRI data package, using the most recent year of correction (2016). As a result of the age of FRI data, some age classes of habitat that would typically be avoided (0 to 5 years) by moose could not be calculated.

b) Refer to Section 6.4 for ecosite descriptions.

3.2 Model Validation

Baseline surveys targeting moose were not conducted for the Project. Incidental observations of moose were recorded in the terrestrial LSA during other field studies (Appendix 6.4A), but the quantity of data was not sufficient for statistical verification of the model. However, model structure and predictive outputs fit with the current state of knowledge regarding the ecology and habitat preferences of this species. The model provides an ecologically relevant and confident assessment of the effects of the Project and previous, existing, and other future developments on moose habitat.

4.0 Gray Fox

Gray foxes are habitat generalists and have been known to use a variety of habitats ranging from forests to agricultural lands to urban areas. Though they are thought to use a higher proportion of wooded habitat than other fox species and are most strongly associated with deciduous forest and prefer landscapes with both wooded and open areas (COSEWIC 2015, MECP 2019). Denning features are often located in wooded or brushy areas that are close to a water source (MECP 2019). Habitat selection is strongly influenced by prey abundance and foraging availability (Temple et al. 2010), and similar to their habitat use, gray fox diets are variable and often dependent on season and geography (MECP 2019). Studies suggest that gray fox prefer a high level of fragmentation of preferred habitat types (i.e., forests and grasslands), where open corridors are available for travel and foraging (Cooper 2012). A recent study in California show that gray fox omnivorous and opportunistic diets lend well to tolerating urbanization and populations can persist in areas where development is present (Larson et al. 2015). Another study found that gray fox are capable of living in areas with varying degrees of development given forested areas are accessible (Lombardi et al. 2017). The Project is located in the northern extent of gray fox habitat, and this habitat is the focus of this assessment.

As outlined in the provincial Recovery Strategy (MECP 2019), the critical habitat for gray fox is based on two components: habitat occupancy and habitat suitability. As such, the known occurrence records within the LSA and RSA, as outlined in baseline characterization, were plotted and a home range average of 274 ha was identified surrounding each occurrence record. Within each home range, ecosites were mapped according to the Project ecosite data. Each ecosite code was assigned a general ecosite description that fit into one of sixteen categories: anthropogenic, barren, bluff, bog, cliff, coniferous forest, deciduous forest, dune, fen, field, marsh, meadow, mixed forest, shoreline, shrub, and swamp. Anthropogenic ecosites are comprised of constructed, utility, residential, and industrial areas.

Total ecosite composition and coverage within the gray fox home ranges in the local and regional study areas was calculated. The results, as outlined in baseline characterization, indicated that deciduous forest cover made up an average of 47% cover. All ecosites that comprised of greater than 1% coverage across home ranges were considered moderate-to-high suitability gray fox habitat. All ecosites that comprised of less than 1% coverage or were not present within home ranges were considered low suitability gray fox habitat. All open water and islands were considered unsuitable gray fox habitat. Ecosite codes, general ecosite descriptions and gray fox habitat suitability are outlined in Table 3.2-1, below.

Table 3.2-1: Ecological Land Classification Ecosites and Gray Fox Habitat Suitability in the Regional Study Area

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B001	Excavated Bluff	Bluff	Low
B004	Bluff	Bluff	Low
B005	Active Mineral Shoreline	Shoreline	Low
B006	Active Sand Dune	Dune	Low
B007	Active Mineral Barren	Barren	Low
B008	Very Shallow, Dry to Fresh: Meadow	Meadow	Moderate-High
B010	Very Shallow, Dry to Fresh: Shrub	Shrub	Moderate-High
B011	Very Shallow, Dry to Fresh: Red Pine - White Pine Conifer	Coniferous Forest	Moderate-High
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B013	Very Shallow, Dry to Fresh: Cedar - Hemlock Conifer	Coniferous Forest	Moderate-High
B014	Very Shallow. Dry to Fresh: Conifer	Coniferous Forest	Moderate-High
B015	Very Shallow, Dry to Fresh: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B017	Very Shallow, Dry to Fresh: Oak Hardwood	Deciduous Forest	Moderate-High
B018	Very Shallow, Dry to Fresh: Maple Hardwood	Deciduous Forest	Moderate-High
B019	Very Shallow, Dry to Fresh: Mixedwood	Mixed Forest	Moderate-High
B024	Very Shallow, Humid: Black Spruce - Pine Conifer	Coniferous Forest	Moderate-High
B025	Very Shallow, Humid: Cedar - Hemlock Conifer	Coniferous Forest	Moderate-High
B028	Very Shallow, Humid: Mixedwood	Mixed Forest	Moderate-High
B030	Dry, Sandy. Meadow	Meadow	Moderate-High
B031	Dry, Sandy: Sparse Shrub	Shrub	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B032	Dry, Sandy: Shrub	Shrub	Moderate-High
B033	Dry, Sandy: Red Pine- White Pine Conifer	Coniferous Forest	Moderate-High
B034	Dry, Sandy: Jack Pine - Black Spruce Dominated	Coniferous Forest	Moderate-High
B035	Dry, Sandy: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B036	Dry, Sandy: Cedar - Hemlock Conifer	Coniferous Forest	Moderate-High
B037	Dry, Sandy: Spruce - Fir Conifer	Coniferous Forest	Moderate-High
B038	Dry, Sandy: Conifer	Coniferous Forest	Moderate-High
B039	Dry. Sandy: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B040	Dry, Sandy. Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B041	Dry, Sandy: Oak Hardwood	Deciduous Forest	Moderate-High
B042	Dry, Sandy: Maple Hardwood	Deciduous Forest	Moderate-High
B044	Dry to Fresh, Coarse: Field	Field	Moderate-High
B045	Dry to Fresh, Coarse: Meadow	Meadow	Moderate-High
B046	Dry to Fresh, Coarse: Sparse Shrub	Shrub	Moderate-High
B047	Dry to Fresh, Coarse: Shrub	Shrub	Moderate-High
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer	Coniferous Forest	Moderate-High
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated	Coniferous Forest	Moderate-High
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B051	Dry to Fresh, Coarse: Cedar - Hemlock Conifer	Coniferous Forest	Moderate-High
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer	Coniferous Forest	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B053	Dry to Fresh, Coarse: Conifer	Coniferous Forest	Moderate-High
B054	Dry to Fresh, Coarse: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood	Deciduous Forest	Moderate-High
B057	Dry to Fresh, Coarse: Oak Hardwood	Deciduous Forest	Moderate-High
B058	Dry to Fresh, Coarse: Maple Hardwood	Deciduous Forest	Moderate-High
B059	Dry to Fresh, Coarse: Mixedwood	Mixed Forest	Moderate-High
B060	Moist, Coarse: Field	Field	Moderate-High
B061	Moist, Coarse: Meadow	Meadow	Moderate-High
B062	Moist, Coarse: Sparse Shrub	Shrub	Moderate-High
B063	Moist, Coarse: Shrub	Shrub	Moderate-High
B064	Moist, Coarse: Red Pine - White Pine Conifer	Coniferous Forest	Moderate-High
B065	Moist, Coarse: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B066	Moist, Coarse: Hemlock - Cedar Conifer	Coniferous Forest	Moderate-High
B067	Moist, Coarse: Spruce - Fir Conifer	Coniferous Forest	Moderate-High
B068	Moist, Coarse: Conifer	Coniferous Forest	Moderate-High
B069	Moist, Coarse: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B070	Moist, Coarse: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B071	Moist, Coarse: Elm - Ash Hardwood	Deciduous Forest	Moderate-High
B073	Moist, Coarse: Sugar Maple Hardwood	Deciduous Forest	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B074	Moist, Coarse: Red Maple Hardwood	Deciduous Forest	Moderate-High
B076	Moist, Coarse: Mixedwood	Mixed Forest	Moderate-High
B078	Fresh, Clayey: Meadow	Meadow	Moderate-High
B080	Fresh, Clayey: Shrub	Shrub	Moderate-High
B081	Fresh, Clayey: Red Pine - White Pine Conifer	Coniferous Forest	Moderate-High
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated	Coniferous Forest	Moderate-High
B083	Fresh, Clayey: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B084	Fresh, Clayey: Hemlock - Cedar Conifer	Coniferous Forest	Moderate-High
B085	Fresh, Clayey: Spruce - Fir Conifer	Coniferous Forest	Moderate-High
B086	Fresh, Clayey: Conifer	Coniferous Forest	Moderate-High
B087	Fresh, Clayey: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B088	Fresh, Clayey: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B089	Fresh, Clayey: Elm - Ash Hardwood	Deciduous Forest	Moderate-High
B091	Fresh, Clayey: Maple Hardwood	Deciduous Forest	Moderate-High
B092	Fresh, Clayey: Mixedwood	Mixed Forest	Moderate-High
B093	Fresh, Silty to Fine Loamy: Field	Field	Moderate-High
B094	Fresh, Silty to Fine Loamy: Meadow	Meadow	Moderate-High
B095	Fresh, Silty to Fine Loamy: Sparse Shrub	Shrub	Moderate-High
B096	Fresh, Silty to Fine Loamy: Shrub	Shrub	Moderate-High
B097	Fresh, Silty to Fine Loamy: Red Pine - White Pine Conifer	Coniferous Forest	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Dominated	Coniferous Forest	Moderate-High
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B100	Fresh, Silty to Fine Loamy: Hemlock - Cedar Conifer	Coniferous Forest	Moderate-High
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	Coniferous Forest	Moderate-High
B102	Fresh, Silty to Fine Loamy: Conifer	Coniferous Forest	Moderate-High
B103	Fresh, Silty to Fine Loamy: Red Pine - White Pine Mixedwood	Mixed Forest	Moderate-High
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B105	Fresh, Silty to Fine Loamy: Elm - Ash Hardwood	Deciduous Forest	Moderate-High
B107	Fresh, Silty to Fine Loamy: Maple Hardwood	Deciduous Forest	Moderate-High
B108	Fresh, Silty to Fine Loamy: Mixedwood	Mixed Forest	Moderate-High
B109	Moist, Fine: Field	Field	Moderate-High
B110	Moist, Fine: Meadow	Meadow	Moderate-High
B111	Moist, Fine: Sparse Shrub	Shrub	Moderate-High
B112	Moist. Fine: Shrub	Shrub	Moderate-High
B113	Moist, Fine: White Pine Conifer	Coniferous Forest	Moderate-High
B114	Moist, Fine: Pine - Black Spruce Conifer	Coniferous Forest	Moderate-High
B115	Moist, Fine: Hemlock - Cedar Conifer	Coniferous Forest	Moderate-High
B116	Moist Fine: Spruce - Fir Conifer	Coniferous Forest	Moderate-High
B117	Moist, Fine: Conifer	Coniferous Forest	Moderate-High
B118	Moist, Fine: White Pine Mixedwood	Mixed Forest	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B119	Moist, Fine: Aspen - Birch Hardwood	Deciduous Forest	Moderate-High
B120	Moist Fine: Elm - Ash Hardwood	Deciduous Forest	Moderate-High
B123	Moist. Fine: Red Maple Hardwood	Deciduous Forest	Moderate-High
B125	Moist. Fine: Mixedwood	Mixed Forest	Moderate-High
B126	Treed Bog	Bog	Low
B127	Organic Poor Conifer Swamp	Swamp	Moderate-High
B128	Organic Intermediate Conifer Swamp	Swamp	Moderate-High
B129	Organic Rich Conifer Swamp	Swamp	Moderate-High
B130	Intolerant Hardwood Swamp	Swamp	Moderate-High
B131	Maple Hardwood Swamp	Swamp	Moderate-High
B133	Hardwood Swamp	Swamp	Moderate-High
B134	Mineral Thicket Swamp	Swamp	Moderate-High
B135	Organic Thicket Swamp	Swamp	Moderate-High
B136	Sparse Treed Fen	Fen	Low
B137	Sparse Treed Bog	Bog	Low
B138	Open Bog	Bog	Low
B139	Poor Fen	Fen	Low
B140	Open Moderately Rich Fen	Fen	Low
B141	Open Extremely Rich Fen	Fen	Low
B142	Mineral Meadow Marsh	Marsh	Moderate-High
B143	Rock Meadow Marsh	Marsh	Moderate-High
B144	Organic Meadow Marsh	Marsh	Moderate-High
B146	Open Shore Fen	Fen	Low

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
B147	Shrub Shore Fen	Fen	Low
B148	Mineral Shallow Marsh	Marsh	Moderate-High
B149	Organic Shallow Marsh	Marsh	Moderate-High
B158	Open Cliff	Cliff	Low
B159	Active Bedrock Shoreline	Shoreline	Low
B161	Open Bedrock Shoreline	Shoreline	Low
B162	Active Rock Barren	Barren	Low
B164	Open Rock Barren	Barren	Low
B165	Active Talus or Historic/Raised Beach	Shoreline	Low
B167	Open Talus or Historic/Raised Beach	Shoreline	Low
B168	Anthropogenic Coarse Shoreline	Shoreline	Low
B171	Open Coarse Shoreline	Shoreline	Low
B172	Calcareous Active Cliff	Cliff	Low
B189	Industrial Waste	Anthropogenic	Moderate-High
B191	Waste Disposal/Landfill	Anthropogenic	Moderate-High
B193	Coarse Clean Fill	Anthropogenic	Moderate-High
B195	Fine Clean Fill	Anthropogenic	Moderate-High
B197	Compact Gravelled Surface	Anthropogenic	Moderate-High
B198	Compact Mineral Surface	Anthropogenic	Moderate-High
B199	Other Materials	Anthropogenic	Moderate-High
B200	Active Coastal Cliff	Cliff	Low
B222	Mineral Poor Conifer Swamp	Swamp	Moderate-High
B223	Mineral Intermediate Conifer Swamp	Swamp	Moderate-High
B224	Mineral Rich Conifer Swamp	Swamp	Moderate-High
U997	Commercial / Industrial Unclassified	Anthropogenic	Moderate-High

Ecosite Code	Ecosite Description	General Ecosite Description	Gray Fox Suitability
U998	Utilities Unclassified	Anthropogenic	Moderate-High
U999	Residential Unclassified	Anthropogenic	Moderate-High
Water	N/A	N/A	Unsuitable
Island	N/A	N/A	Unsuitable

5.0 Beaver

5.1 Habitat Requirements and Predicted Suitability

The beaver is a semi-aquatic mammal that is found throughout forested regions of Canada. Beavers select habitat based on a variety of characteristics including stream gradient, stream size and depth, watershed size, valley or floodplain width, substrate type, and riparian slope (Touihri et al. 2018). Beavers inhabit a variety of aquatic habitats such as lakes, ponds, and slow-flowing streams (Cassola 2016). Beavers build lodges out of mud, sticks, logs, and debris in areas that are near abundant food supplies, lodge construction material, and in waterbodies that are deep enough so that the underwater lodge entrance does not freeze during winter. Beavers are herbivores and prefer to consume trembling aspen and willows but will consume the leaves, twigs, and bark of many woody plant species that grow near waterbodies including coniferous trees and shrubs (less preferred) (Jenkins and Busher 1979; Allen 1983).

Beavers have been observed to forage at distances of up to 200 m from the lodge and associated waterbody; however, the majority of foraging occurred within 100 m of the shoreline (Allen 1983). Foraging up to 78 m from a waterbody was found during studies completed in the mixed boreal forest of central Alberta (Skinner 1984; Hood and Bayley 2007). According to Allen (1983), small lakes (less than 8 ha in surface area) provide suitable habitat for beaver. Larger lakes may provide suitable habitat if irregular shorelines are available (e.g., bays, coves, and inlets). During baseline surveys for the Project, active beaver lodges were observed more often along creeks than lake shorelines (Appendix 6.4A).

The beaver habitat model was used to predict suitable lodge locations, food, and cover in the RSA. It was assumed that beaver distribution was similar across seasons because these animals are central-place foragers moving out from the lodge to select food that may be consumed or transported back to the dwelling (Basey and Jenkins 1995). The model incorporated the suitability of open water and wetlands for establishing a lodge and the suitability of adjacent terrestrial habitat containing food and cover and material for lodge construction. While open water provides little value with respect to forage for beaver, it is suitable in terms of cover, breeding and social behaviours, and lodge habitat (Novak 1987). The model assumed that large lakes (less than 8 ha in surface area) provided negligible shelter from wind and wave action and provided poor quality beaver habitat.

Habitat suitability rankings of landcover types and ecosites for beaver lodge location in the RSA were assigned based on the information above (Table 5.1-1). Habitat suitability rankings for upland ecosites predicted to provide cover and food for beaver within 100 m of open water (less than 8 ha in surface area) and wetlands (with more than 1% water cover) are provided in Table 5.1-2.

Table 5.1-1: Habitat Suitability of Landcover Types and Ecosites for Beaver Lodge Location

Landcover Types	Ecosite Description	Ecosite[(a)]	Suitability
Open water (<8 ha in surface area)		Water	High
Wetland (average cover is >21% water)	marshes, fens	B136, B139, B140, B141, B142, B143, B144, B145, B146, B147, B148, B149, B150, B151, B152, B216, B217, B218, B219, B220	High
Wetland (average cover is 6%-20% water)	thicket swamp	B134, B135	Moderate
Wetland (average cover is 1%-5% water)	bogs	B126, B137, B138	Low
Wetland (Average cover is <1% water)	treed swamps	B127, B128, B129, B130, B131, B132, B133, B215, B221, B222, B223	Poor
Recent burn		Recent burn (upland); Recent burn (wetland)	Poor
Upland habitat	deciduous, mixed, conifer	B011-019, B023-028, B033-043, B048-059, B064-076, B081-092, B097-108, B113-125	Poor
Unvegetated bedrock	barren, anthro, cliff, shoreline, bedrock, bluff, dune	B001, B002, B003, B004, B005, B006, B007, B153, B154, B155, B156, B157, B158, B159, B160, B161, B162, B163, B164, B165, B166, B167, B168, B169, B170, B171, B172, B173, B174, B175, B176, B177, B178, B179, B180, B181, B182, B183, B184, B185, B186, B187, B200, B201, B202, B203, B204, B205, B206, B207, B208, B209, B210, B211, B212, B213, B214	Poor
Existing disturbance	field, meadow, shrub, residential, waste disposal, pavement, fill, etc.	B188, B189, B190, B191, B192, B193, B194, B195, B196, B197, B198, B199, U997, U998, U999	Poor
Open water (>8 ha in surface area)	unknown	Water	Poor

a) Ecosites taken from FRI metadata category PriEco_Prefix IN

< = less than; > = greater than.

Table 5.1-2: Habitat Suitability of Landcover Types and Ecosites for Beaver within 100 m of Open Water and Wetlands

Landcover Types	Ecosite Description	Ecosite[a]	Suitability
Deciduous forest (poplar dominant)	Aspen-birch hardwood	'B016','B040','B055','B070','B088','B104','B119','B134','B135'	High
Shrubby (willow) wetland	Thicket swamp	'B016','B040','B055','B070','B088','B104','B119','B134','B135'	High
Pine-dominant mixed forest	Mixed forest	'B011','B012','B015','B019','B023','B024','B027','B028','B033','B034','B035','B039','B043','B048','B049','B050','B054','B059','B064','B065','B069','B076','B081','B082','B083','B087','B092','B097','B098','B099','B103','B108','B113','B114','B118','B125'	Moderate
Coniferous forest and Deciduous forest (birch dominant)	Upland conifer and treed swamps and all maple, elm-ash and oak hardwoods	'B013','B014','B017','B018','B025','B026','B036','B037','B038','B041','B042','B051','B052','B053','B056','B057','B058','B066','B067','B068','B071','B072','B073','B074','B075','B084','B085','B086','B089','B090','B091','B100','B101','B102','B105','B106','B107','B115','B116','B117','B120','B121','B122','B123','B124','B127','B128','B129','B130','B131','B132','B133','B215','B221','B222','B223'	Low

Note: Open water with less than 8 ha in surface area; wetlands with more than 1% water cover.

a) Ecosites taken from FRI metadata category PriEco_Prefix IN

Beavers were assumed to be unaffected by human-related activities. For example, dams are often created at man-made structures (e.g., culverts; Boyles and Savitzky 2008). A study found no evidence that anthropogenic linear features decreased the likelihood of occurrence or distribution of beaver (Mumma et al. 2018). Based on this information, no buffer (i.e., zone of influence) was applied to human disturbance types (Table 5.1-1). However, habitat suitability for beaver considered human disturbance (Table 5.1-1).

5.2 Model Validation

Baseline surveys recorded active beaver lodges along waterbodies in the RSA, which provided support for the model, but the quantity of data was not sufficient for statistical verification. However, model structure and predictive outputs fit with the current state of knowledge regarding the ecology and suitability of lodge location for beavers, which is strongly tied to more open wetlands and adjacent deciduous upland. The model provides an ecologically relevant and confident assessment of the effects of the Project and previous, existing, and other future developments on beaver lodge habitat.

6.0 American Marten

Availability and distribution of American marten (Martes Americana) habitat was estimated and mapped using FRI data in a GIS platform. Habitat mapping for American marten was based primarily on the habitat suitability models used to predict marten habitat in the province as a tool for forest management (OMNR 2014). Moderate to high quality habitats were mapped according to the following parameters:

- Suitable forest unit; and
- Seral stage mature and overmature.

Suitable forest units are the forest units defined in the guide as mature forests older than 50 years with greater than 30% to 40% conifer species (OMNR 2014).

Table 6.0-1: Forest Ecosite Codes and Age Classification to Apply American Marten Habitat Suitability

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B013	Very Shallow, Dry to Fresh: Cedar - Hemlock Conifer	suitable	mature
B019	Very Shallow, Dry to Fresh: Mixedwood	suitable	mature
B025	Very Shallow, Humid: Cedar - Hemlock Conifer	suitable	mature
B028	Very Shallow, Humid: Mixedwood	suitable	mature
B034	Dry, Sandy: Jack Pine - Black Spruce Dominated	suitable	mature
B036	Dry, Sandy: Cedar - Hemlock Conifer	suitable	mature
B043	Dry, Sandy: Mixedwood	suitable	mature
B049	Dry to Fresh, Coarse: Jack Pine - Black Spruce Dominated	suitable	mature
B051	Dry to Fresh, Coarse: Cedar - Hemlock Conifer	suitable	mature
B059	Dry to Fresh, Coarse: Mixedwood	suitable	mature
B066	Moist, Coarse: Hemlock - Cedar Conifer	suitable	mature
B076	Moist, Coarse: Mixedwood	suitable	mature
B082	Fresh, Clayey: Jack Pine - Black Spruce Dominated	suitable	mature
B084	Fresh, Clayey: Hemlock - Cedar Conifer	suitable	mature
B092	Fresh, Clayey: Mixedwood	suitable	mature
B098	Fresh, Silty to Fine Loamy: Jack Pine - Black Spruce Dominated	suitable	mature

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B100	Fresh, Silty to Fine Loamy: Hemlock - Cedar Conifer	suitable	mature
B108	Fresh, Silty to Fine Loamy: Mixedwood	suitable	mature
B115	Moist, Fine: Hemlock - Cedar Conifer	suitable	mature
B117	Moist, Fine: Conifer	suitable	mature
B011	Very Shallow, Dry to Fresh: Red Pine - White Pine Conifer	suitable	overmature
B012	Very Shallow, Dry to Fresh: Pine - Black Spruce Conifer	suitable	overmature
B014	Very Shallow. Dry to Fresh: Conifer	suitable	overmature
B015	Very Shallow, Dry to Fresh: Red Pine - White Pine Mixedwood	suitable	overmature
B023	Very Shallow, Humid: Red Pine - White Pine Conifer	suitable	overmature
B024	Very Shallow, Humid: Black Spruce - Pine Conifer	suitable	overmature
B026	Very Shallow, Humid: Conifer	suitable	overmature
B027	Very Shallow, Humid: Red Pine - White Pine Mixedwood	suitable	overmature
B033	Dry, Sandy: Red Pine- White Pine Conifer	suitable	overmature
B035	Dry, Sandy: Pine - Black Spruce Conifer	suitable	overmature
B037	Dry, Sandy: Spruce - Fir Conifer	suitable	overmature
B038	Dry, Sandy: Conifer	suitable	overmature
B039	Dry. Sandy: Red Pine - White Pine Mixedwood	suitable	overmature
B048	Dry to Fresh, Coarse: Red Pine - White Pine Conifer	suitable	overmature
B050	Dry to Fresh, Coarse: Pine - Black Spruce Conifer	suitable	overmature
B052	Dry to Fresh, Coarse: Spruce - Fir Conifer	suitable	overmature
B053	Dry to Fresh, Coarse: Conifer	suitable	overmature
B054	Dry to Fresh, Coarse: Red Pine - White Pine Mixedwood	suitable	overmature
B064	Moist, Coarse: Red Pine - White Pine Conifer	suitable	overmature
B065	Moist, Coarse: Pine - Black Spruce Conifer	suitable	overmature
B067	Moist, Coarse: Spruce - Fir Conifer	suitable	overmature
B068	Moist, Coarse: Conifer	suitable	overmature

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B069	Moist, Coarse: Red Pine - White Pine Mixedwood	suitable	overmature
B081	Fresh, Clayey: Red Pine - White Pine Conifer	suitable	overmature
B083	Fresh, Clayey: Pine - Black Spruce Conifer	suitable	overmature
B085	Fresh, Clayey: Spruce - Fir Conifer	suitable	overmature
B086	Fresh, Clayey: Conifer	suitable	overmature
B087	Fresh, Clayey: Red Pine - White Pine Mixedwood	suitable	overmature
B097	Fresh, Silty to Fine Loamy: Red Pine - White Pine Conifer	suitable	overmature
B099	Fresh, Silty to Fine Loamy: Pine - Black Spruce Conifer	suitable	overmature
B101	Fresh, Silty to Fine Loamy: Spruce - Fir Conifer	suitable	overmature
B102	Fresh, Silty to Fine Loamy: Conifer	suitable	overmature
B103	Fresh, Silty to Fine Loamy: Red Pine - White Pine Mixedwood	suitable	overmature
B113	Moist, Fine: White Pine Conifer	suitable	overmature
B114	Moist, Fine: Pine - Black Spruce Conifer	suitable	overmature
B116	Moist Fine: Spruce - Fir Conifer	suitable	overmature
B118	Moist, Fine: White Pine Mixedwood	suitable	overmature
B125	Moist. Fine: Mixedwood	suitable	overmature
B126	Treed Bog	suitable	overmature
B127	Organic Poor Conifer Swamp	suitable	overmature
B128	Organic Intermediate Conifer Swamp	suitable	overmature
B129	Organic Rich Conifer Swamp	suitable	overmature
B136	Sparse Treed Fen	suitable	overmature
B137	Sparse Treed Bog	suitable	overmature
B139	Poor Fen	suitable	overmature
B221	Mineral Poor Conifer Swamp	suitable	overmature
B222	Mineral Intermediate Conifer Swamp	suitable	overmature
B223	Mineral Rich Conifer Swamp	suitable	overmature
B001	Excavated Bluff	unsuitable	N/A
B002	Active Bluff	unsuitable	N/A
B003	Active Bluff	unsuitable	N/A
B004	Bluff	unsuitable	N/A
B005	Active Mineral Shoreline	unsuitable	N/A
B006	Active Sand Dune	unsuitable	N/A

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B007	Active Mineral Barren	unsuitable	N/A
B008	Very Shallow, Dry to Fresh: Meadow	unsuitable	N/A
B009	Very Shallow, Dry to Fresh: Sparse Shrub	unsuitable	N/A
B010	Very Shallow, Dry to Fresh: Shrub	unsuitable	N/A
B016	Very Shallow, Dry to Fresh: Aspen - Birch Hardwood	unsuitable	N/A
B017	Very Shallow, Dry to Fresh: Oak Hardwood	unsuitable	N/A
B018	Very Shallow, Dry to Fresh: Maple Hardwood	unsuitable	N/A
B020	Very Shallow, Humid: Meadow	unsuitable	N/A
B021	Very Shallow, Humid: Sparse Shrub	unsuitable	N/A
B022	Very Shallow, Humid: Shrub	unsuitable	N/A
B029	Dry, Sandy. Field	unsuitable	N/A
B030	Dry, Sandy. Meadow	unsuitable	N/A
B031	Dry, Sandy: Sparse Shrub	unsuitable	N/A
B032	Dry, Sandy: Shrub	unsuitable	N/A
B040	Dry, Sandy. Aspen - Birch Hardwood	unsuitable	N/A
B041	Dry, Sandy: Oak Hardwood	unsuitable	N/A
B042	Dry, Sandy: Maple Hardwood	unsuitable	N/A
B044	Dry to Fresh, Coarse: Field	unsuitable	N/A
B045	Dry to Fresh, Coarse: Meadow	unsuitable	N/A
B046	Dry to Fresh, Coarse: Sparse Shrub	unsuitable	N/A
B047	Dry to Fresh, Coarse: Shrub	unsuitable	N/A
B055	Dry to Fresh, Coarse: Aspen - Birch Hardwood	unsuitable	N/A
B056	Dry to Fresh, Coarse: Elm - Ash Hardwood	unsuitable	N/A
B057	Dry to Fresh, Coarse: Oak Hardwood	unsuitable	N/A
B058	Dry to Fresh, Coarse: Maple Hardwood	unsuitable	N/A
B060	Moist, Coarse: Field	unsuitable	N/A
B061	Moist, Coarse: Meadow	unsuitable	N/A
B062	Moist, Coarse: Sparse Shrub	unsuitable	N/A
B063	Moist, Coarse: Shrub	unsuitable	N/A
B070	Moist, Coarse: Aspen - Birch Hardwood	unsuitable	N/A
B071	Moist, Coarse: Elm - Ash Hardwood	unsuitable	N/A
B072	Moist, Coarse: Oak Hardwood	unsuitable	N/A
B073	Moist, Coarse: Sugar Maple Hardwood	unsuitable	N/A

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B074	Moist, Coarse: Red Maple Hardwood	unsuitable	N/A
B075	Moist, Coarse: Maple Hardwood	unsuitable	N/A
B077	Fresh, Clayey: Field	unsuitable	N/A
B078	Fresh, Clayey: Meadow	unsuitable	N/A
B079	Fresh, Clayey: Sparse Shrub	unsuitable	N/A
B080	Fresh, Clayey: Shrub	unsuitable	N/A
B088	Fresh, Clayey: Aspen - Birch Hardwood	unsuitable	N/A
B089	Fresh, Clayey: Elm - Ash Hardwood	unsuitable	N/A
B090	Fresh, Clayey: Oak Hardwood	unsuitable	N/A
B091	Fresh, Clayey: Maple Hardwood	unsuitable	N/A
B093	Fresh, Silty to Fine Loamy: Field	unsuitable	N/A
B094	Fresh, Silty to Fine Loamy: Meadow	unsuitable	N/A
B095	Fresh, Silty to Fine Loamy: Sparse Shrub	unsuitable	N/A
B096	Fresh, Silty to Fine Loamy: Shrub	unsuitable	N/A
B104	Fresh, Silty to Fine Loamy: Aspen - Birch Hardwood	unsuitable	N/A
B105	Fresh, Silty to Fine Loamy: Elm - Ash Hardwood	unsuitable	N/A
B106	Fresh, Silty to Fine Loamy: Oak Hardwood	unsuitable	N/A
B107	Fresh, Silty to Fine Loamy: Maple Hardwood	unsuitable	N/A
B109	Moist, Fine: Field	unsuitable	N/A
B110	Moist, Fine: Meadow	unsuitable	N/A
B111	Moist, Fine: Sparse Shrub	unsuitable	N/A
B112	Moist. Fine: Shrub	unsuitable	N/A
B119	Moist, Fine: Aspen - Birch Hardwood	unsuitable	N/A
B120	Moist Fine: Elm - Ash Hardwood	unsuitable	N/A
B121	Moist, Fine: Oak Hardwood	unsuitable	N/A
B122	Moist Fine: Sugar Maple Hardwood	unsuitable	N/A
B123	Moist. Fine: Red Maple Hardwood	unsuitable	N/A
B124	Moist. Fine: Maple Hardwood	unsuitable	N/A
B130	Intolerant Hardwood Swamp	unsuitable	N/A
B131	Maple Hardwood Swamp	unsuitable	N/A
B132	Oak Hardwood Swamp	unsuitable	N/A
B133	Hardwood Swamp	unsuitable	N/A
B134	Mineral Thicket Swamp	unsuitable	N/A
B135	Organic Thicket Swamp	unsuitable	N/A

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B138	Open Bog	unsuitable	N/A
B140	Open Moderately Rich Fen	unsuitable	N/A
B141	Open Extremely Rich Fen	unsuitable	N/A
B142	Mineral Meadow Marsh	unsuitable	N/A
B143	Rock Meadow Marsh	unsuitable	N/A
B144	Organic Meadow Marsh	unsuitable	N/A
B145	Floating Marsh	unsuitable	N/A
B146	Open Shore Fen	unsuitable	N/A
B147	Shrub Shore Fen	unsuitable	N/A
B148	Mineral Shallow Marsh	unsuitable	N/A
B149	Organic Shallow Marsh	unsuitable	N/A
B150	Open Water Marsh: Floating-leaved	unsuitable	N/A
B151	Open Water Marsh: Mineral	unsuitable	N/A
B152	Open Water Marsh: Organic	unsuitable	N/A
B153	Active Limnetic Rock	unsuitable	N/A
B154	Active Limnetic Mineral	unsuitable	N/A
B155	Active Limnetic Organic	unsuitable	N/A
B156	Active Cliff	unsuitable	N/A
B157	Cliff	unsuitable	N/A
B158	Open Cliff	unsuitable	N/A
B159	Active Bedrock Shoreline	unsuitable	N/A
B160	Bedrock Shoreline	unsuitable	N/A
B161	Open Bedrock Shoreline	unsuitable	N/A
B162	Active Rock Barren	unsuitable	N/A
B163	Rock Barren	unsuitable	N/A
B164	Open Rock Barren	unsuitable	N/A
B165	Active Talus or Historic/Raised Beach	unsuitable	N/A
B166	Talus or Historic/Raised Beach	unsuitable	N/A
B167	Open Talus or Historic/Raised Beach	unsuitable	N/A
B168	Anthropogenic Coarse Shoreline	unsuitable	N/A
B169	Active Coarse Shoreline	unsuitable	N/A
B170	Coarse Shoreline	unsuitable	N/A
B171	Open Coarse Shoreline	unsuitable	N/A
B172	Calcareous Active Cliff	unsuitable	N/A
B173	Calcareous Cliff	unsuitable	N/A
B174	Calcareous Open Cliff	unsuitable	N/A
B175	Calcareous Active Bedrock Shoreline	unsuitable	N/A
B176	Calcareous Bedrock Shoreline	unsuitable	N/A

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B177	Calcareous Open Bedrock Shoreline	unsuitable	N/A
B178	Calcareous Active Rock Barren	unsuitable	N/A
B179	Calcareous Rock Barren	unsuitable	N/A
B180	Calcareous Open Rock Barren	unsuitable	N/A
B181	Calcareous Active Talus or Historic/Raised Beach	unsuitable	N/A
B182	Calcareous Talus or Historic/Raised Beach	unsuitable	N/A
B183	Calcareous Open Talus or Historic/Raised Beach	unsuitable	N/A
B184	Calcareous Anthropogenic Coarse Shoreline	unsuitable	N/A
B185	Calcareous Active Coarse Shoreline	unsuitable	N/A
B186	Calcareous Coarse Shoreline	unsuitable	N/A
B187	Calcareous Open Coarse Shoreline	unsuitable	N/A
B188	Constructed Vertical Surface	unsuitable	N/A
B189	Industrial Waste	unsuitable	N/A
B190	Active Waste Disposal/Landfill	unsuitable	N/A
B191	Waste Disposal/Landfill	unsuitable	N/A
B192	Active Coarse Clean Fill	unsuitable	N/A
B193	Coarse Clean Fill	unsuitable	N/A
B194	Active Fine Clean Fill	unsuitable	N/A
B195	Fine Clean Fill	unsuitable	N/A
B196	Pavement/Concrete	unsuitable	N/A
B197	Compact Gravelled Surface	unsuitable	N/A
B198	Compact Mineral Surface	unsuitable	N/A
B199	Other Materials	unsuitable	N/A
B200	Active Coastal Cliff	unsuitable	N/A
B201	Open Coastal Cliff	unsuitable	N/A
B202	Coastal Cliff	unsuitable	N/A
B203	Active Coastal Bedrock Shoreline	unsuitable	N/A
B204	Open Coastal Bedrock Shoreline	unsuitable	N/A
B205	Coastal Bedrock Shoreline	unsuitable	N/A
B206	Active Coastal Coarse Shoreline	unsuitable	N/A
B207	Open Coastal Coarse Shoreline	unsuitable	N/A
B208	Coastal Coarse Shoreline	unsuitable	N/A
B209	Active Coastal Bluff	unsuitable	N/A
B210	Open Coastal Bluff	unsuitable	N/A
B211	Coastal Bluff	unsuitable	N/A

Ecosite Code	Ecosite Name	Suitability	Seral Stage (mature 70-80; overmature=80+)
B212	Active Coastal Mineral Shoreline	unsuitable	N/A
B213	Active Coastal Sand Dune	unsuitable	N/A
B214	Coastal Mineral Barren	unsuitable	N/A
B215	Salt Thicket Swamp	unsuitable	N/A
B216	Salt Poor Fen	unsuitable	N/A
B217	Open Salt Fen	unsuitable	N/A
B218	Salt Meadow Marsh	unsuitable	N/A
B219	Salt Marsh	unsuitable	N/A
B220	Open Salt Marsh	unsuitable	N/A
U997	Commercial / Industrial Unclassified	unsuitable	N/A
U998	Utilities Unclassified	unsuitable	N/A
U999	Residential Unclassified	unsuitable	N/A

References

Allen A.W. 1983. Habitat suitability index models: beaver (FWS/OBS-82/10.30). US Fish and Wildlife Service. Fort Collins, Colorado, USA.

Allen, A.W., P.A. Jordan, and J.W. Terrel. 1987. Habitat Suitability Index Models: Moose, Lake Superior Region. Fish and Wildlife Service, U.S. Department of the Interior, Biological Report 82:10(155) 60.

Altman, B. and R. Sallabanks. 2012. *Olivesided Flycatcher (Contopus cooperi)*. Cornell Lab of Ornithology, Ithaca, NY. Available at: http://bna.birds.cornell.edu/bna/species/502.

Armstrong, T.E.R. 2014. Management Plan for the Bald Eagle (*Haliaeetus leucocephalus*) in Ontario. Ontario Management Plan Series. Prepared for the Ontario Ministry of Natural Resources and Forestry, Peterborough, Ontario. vii + 53 pp. Available online at: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_mp_bldegl_en.pdf . Accessed July 6, 2016.

Ball, J.R. and E.M. Bayne. 2014. Status of Canada warbler (*Cardellina canadensis*) in Alberta. Alberta Wildlife Status Report No. 70. Prepared for Alberta Environment and Sustainable Resource Development (ESRD) and Alberta Conservation Association (ACA).

Basey JM, Jenkins SH. 1995. Influences of predation risk and energy maximization on food selection by beavers (Castor canadensis). Canadian Journal of Zoology 73: 2197-2208.

Boyles SL, Savitzky BA. 2008. An analysis of the efficacy and comparative cost of using flow devices to resolve conflicts with North American beavers along roadways in the Coastal Plain of Virginia. Proceeding 23rd Vertebrate Pest Conference (RM Timm and dMB Mason, Eds.). Published at University of California, Davis. Pp. 47-52.

Brigham, R.M., J. Ng, R.G. Poulin, and S.D. Grindal. 2011. Common Nighthawk (Chordeiles minor), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology. [accessed March 2017].

Brooks, R.P. 1997. Improving Habitat Suitability Index Models. Wildlife Society Bulletin 25:163-167.

Brown, M.B. and C.R. Brown. 2020. Barn Swallow (Hirundo rustica), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.barswa.01

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/506. doi:10.2173/bna.506.

Bushman, E.S. and G.D. Therres. 1988. Habitat management guidelines for forest interior breeding birds of coastal Maryland. Maryland Department of Natural Resources, Forest, Park and Wildlife Service. Wildlife Technical Publication 881. 54pp.

Cadman, M. D., D. A. Sutherland, G. G. Beck, D. Lepage, and A. R. Couturier. 2007. Atlas of the breeding birds of Ontario, 2001–2005. Bird Studies Canada, Port Rowan, Ontario, Canada.

Cassola, F. 2016. Castor canadensis. The IUCN Red List of Threatened Species 2016: e.T4003A22187946. https://dx.doi.org/10.2305/IUCN.UK.2016-3.RLTS.T4003A22187946.en.

Cink, C.L. 2002. Eastern Whippoorwill (*Antrostomus vociferus*), The Birds of North America (P.G. Rodewald, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America: https://birdsna.org/SpeciesAccount/bna/species/whipp1.

Cooper, S.E., C.K. Nielsen, and P.T. McDonald. 2012. Landscape factors affecting relative abundance of gray foxes Urocyon cinereoargenteus at large scales in Illinois, USA. Wildlife Biology 18, no. 4: 366-373

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007a. COSEWIC assessment and status report on the common nighthawk Chordeiles minor in Canada. Ottawa. vi + 25 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2007b. COSEWIC assessment and status report on the Olivesided Flycatcher *Contopus cooperi* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vii + 25 pp.

COSEWIC. 2008. COSEWIC assessment and status report on the Canada warbler *Wilsonia canadensis* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 35 pp.

COSEWIC. 2009. COSEWIC assessment and status report on the Whippoorwill *Caprimulgus vociferus* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 28 pp.

COSEWIC. 2010. COSEWIC assessment and status report on the Bobolink Dolichonyx oryzivorus in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 42 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

COSEWIC. 2012. COSEWIC assessment and status report on the Eastern Wood-pewee Contopus virens in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. x + 39 pp. (www.registrelep-sararegistry.gc.ca/default_e.cfm).

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2015. COSEWIC Assessment and Status Report on the Gray Fox Urocyon cinereoargenteus in Canada – 2015. Available at: https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry/cosewic-assessments-status-reports/gray-fox-2015.html

COSEWIC. 2018. COSEWIC assessment and status report on the Chimney Swift Chaetura pelagica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 63 pp. (http://www.registrelep-sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1).

COSEWIC. 2021. COSEWIC assessment and status report on the Barn Swallow Hirundo rustica in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. xii + 60 pp. (https://www.canada.ca/en/environment-climate-change/services/species-risk-public-registry.html).

Elkie P., A. Smiegielski, J. Elliot, R. Kushneriuk and R.S. Rempel. 2013. Ontario's Landscape Tool User's Manual. Version 2013. Ontario Ministry of Natural Resources. Policy Division, Forests Branch, Policy Section, Guides Unit. Sault Ste. Marie Ontario.

Environment Canada. 2015. Recovery Strategy for the Canada Warbler (*Cardellina canadensis*) in Canada. Species at Risk Act Recovery Strategy Series. Environment Canada, Ottawa. vii + 56 pp.

Garrison, B. A. and Turner, A. 2020. Bank Swallow Riparia riparia. The cornell lab of omithology. https://birdsoftheworld.org/bow/species/banswa/cur/introduction

Government of Ontario. 2015a. Eastern whip-poor-will. Available at: https://www.ontario.ca/page/eastern-whip-poor-will. Accessed: September 25, 2016.

Government of Ontario. 2015b. Olive-sided flycatcher. Available at: https://www.ontario.ca/page/olive-sided-flycatcher. Accessed: September 25, 2016.

Grier, J.W., and J.E Guinn. 2003. Bald Eagle habitats and responses to human disturbance in Minnesota. Final Report to Minnesota Department of Natural Resources. North Dakota State University,
Fargo ND. 44 pp.

Hall, B.C.E. 1998. Characterization of Bald Eagle Winter Night Roost Habitat Along the Upper Mississippi River. Department of Resource Analysis, Saint Mary's University of Minnesota, Winona, MN 55987 Thesis (M.S.)-.)Saint- Mary's University of Minnesota. http://www.gis.smumn.edu/GradProjects/HallB.pdf

Higgelke PE. 1994. Simulation analysis of Ontario's Moose habitat guidelines. M.Sc.F. Thesis, Lakehead University, Thunder Bay, ON. 157 pp.

Hood GA, Bayley, SE, Olson, W. 2007. Effects of prescribed fire on habitat of beaver (Castor canadensis) in Elk Island National Park, Canada. Forest Ecology and Management 239 (1-3, 15): 200-209.

Jenkins SH, Busher PE. 1979. Castor canadensis. Mammalian Species 120: 1-8.

Johnson, A., J. Wiens, B. Milne, and T. Crist. 1992. Animal movements and population dynamics in heterogeneous landscapes. Landscape Ecology. 7:63–75.

Jung, T.S., I.D. Thompson, R.D. Titman, and A.P. Applejohn. 1999. Habitat selection by forest bats in relation to mixedwood stand types and structure in central Ontario. Journal of Wildlife Management 63: 2: 13061319.

Larson, R.N., D.J. Morin, I.A. Wierzbowska, and K.R. Crooks. 2015. Food habits of coyotes, gray foxes, and bobcats in a coastal southern California urban landscape. Western North American Naturalist 339-347.

Laurian C, Dussault C, Ouellet JP, Courtois R, Poulin M, Breton L. 2008. Behaviour of moose relative to a road network. Journal of Wildlife Management 72(7): 1550-1557.

Lombardi, J.V., C.E. Comer, D.G. Scognamillo and W.C., Conway. 2017. Coyote, fox, and bobcat response to anthropogenic and natural landscape features in a small urban area. Urban Ecosystems 20, no. 6: 1239-1248.

Marzluff, J.M., J.J. Millspaugh, K.R. Cedar, C.D. Oliver, J. Withey, J.B. McCarter, C.L. Mason, and J. Comnick. 2002. *Modelling Changes in Wildlife Habitat and Timber Revenues in Response to Forest Management*. Forest Science 48(2):191202.

McCracken, J.D., R.A. Reid, R.B. Renfrew, B. Frei, J.V. Jalava, A. Cowie, and A.R. Couturier. 2013. Recovery Strategy for the Bobolink (Dolichonyx oryzivorus) and Eastern Meadowlark (Sturnella magna) in Ontario. Ontario Recovery Strategy Series. Prepared for the Ontario Ministry of Natural Resources, Peterborough, Ontario. viii + 88 pp.

McGarigal, K. and W.C. McComb 1995. Relationships between landscape structure and breeding birds in the Oregon Coast Range. Ecological Monographs 65:235260.

MECP (Ministry of the Environment, Conservation and Parks). 2019. Recovery Strategy for the Gray Fox (Urocyon cinereoargenteus) in Ontario. Ontario Recovery Strategy Series. Prepared by the Ministry of the Environment, Conservation and Parks, Peterborough, Ontario. iv + 5 pp. + Appendix. Adoption of the Recovery Strategy for Grey Fox (Urocyon cinereoargenteus) in Canada (Environment Canada 2018).

Miller BK, Litvaitis JA. 1992. Use of roadside salt licks by Moose, Alces alces, in northern New Hampshire. Canadian Field-Naturalist 106(1): 112117.

Mitchell, C.D. and M.W. Eichholz. 2020. Trumpeter Swan (Cygnus buccinator), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. https://doi.org/10.2173/bow.truswa.01

MNR. 2009. Forest Information Manual 2009: Forest Resources Inventory Technical Specification Draft for August 2009. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/2837/fim-tech-spec-forest-resources-inventory.pdf.

MNR. 2012. Science and information in support of Ontario's forest management guides for landscapes: Science Package Series A. Toronto: Queen's Printer for Ontario.

MNR. 2013. General habitat description for the eastern whip-poor-will (*Caprimulgus vociferus*). Available at: http://files.ontario.ca/environment-and-energy/species-at-risk/mnr_sar_ghd_whp_pr_wll_en.pdf. Accessed: July 5, 2016. 4 pp.

MNR. 2014. *Forest management guide for boreal landscapes.* Toronto: Queen’s Printer for Ontario.

MNR. 2014. Provincial wildlife population monitoring program plan. King’s printer for Ontario. https://www.ontario.ca/page/provincial-wildlife-population-monitoring-program-plan

MNRF. 2015. Bank swallow. King’s printer for Ontario. https://www.ontario.ca/page/bank-swallow#:~:text=Bank%20swallows%20nest%20in%20burrows%20in%20natural%20and,ranging%20from%20several%20to%20a%20few%20thousand%20pairs.

MNRF. 2015. Eastern whip-poor-will. King’s printer for Ontario. Eastern whip-poor-will | ontario.ca

MNRF. 2017. Sensitive species data. Received from the MNRF September 2017.

Mumma MA, Gillingham MP, Johnson CJ, Parker KL. 2018. Where beavers (Castor canadensis) build: Testing the influence of habitat quality, predation risk, and anthropogenic disturbance on colony occurrence. Canadian Journal of Zoology. doi: 10.1139/cjz-2017-0327.

Mytton WR, Keith LB. 1981. Dynamics of moose populations near Rochester, Alberta, 1975-1978. Canadian Field-Naturalist 95: 39–49.

Nelson JL, Zavaleta ES, Chapin FS III. 2008. Boreal fire effects on subsistence resources in Alaska and adjacent Canada. Ecosystems 11:156–171.

Novak M. 1987. Beaver. Wild Furbearer Management & Conservation in North America, section IV: Species Biology, Management and Conservation. 25:282-312.

OMNR (Ontario Ministry of Natural Resources). 1988. Timber Management Guidelines for the Provision of Moose Habitat. Accessed on January 2020. Available at: https://dr6j45jk9xcmk.cloudfront.net/documents/2800/guide-moosehabitat.pdf

Peek, J.M., M.D. Scott, L.J. Nelson, D.J. Pierce, and L.L. Irwin. 1982. Role of cover in habitat management for big game in northwestern United States. Transactions of the 47th North American Wildlife and Natural Resources Conference. Cited in T. Romito, K. Smith, B. Beck, J. Beck, M. Todd, R. Bonar, and R. Quilan. 1999. Moose winter habitat: habitat suitability index model Version 5. Foothills Research Institute. [accessed July 2016]. Available at: http://foothillsresearchinstitute.ca/pages/Publications/PublicationByProgram.aspx?program=720.

Poole KG, Stuart-Smith K. 2004. Winter habitat selection by moose in the East Kootenay, British Columbia, Final Report. Prepared for Tembec Industries Inc. Nelson BC: Aurora Wildlife Research; Accessed March 2021. Available at http://www.env.gov.bc.ca/wildlife/wsi/reports/2486_TEMBEC%20MOOSE%20REPT%20FINAL.PDF

Renfrew, R., Strong, A. M., Perlut, N. G., Martin, S. G and Gavin T. A. 2020. Bobolink Dolichonyx oryzivorus. The cornell lab of ornithology. https://birdsoftheworld.org/bow/species/boboli/cur/introduction.

Romito T, Smith K, Beck B, Beck J, Todd M, Bonar R, Quinlan R. 1999. Moose winter habitat: habitat suitability index model Version 5. Foothills Research Institute. Accessed September 2019. Available at https://friresearch.ca/resource/moose-winter-habitat-habitat-suitability-index-model

Serrouya R, D'Eon R. 2002. Moose habitat selection in relation to forest harvesting in a deep snow zone of British Columbia. Prepared for Downie Timber Ltd. and Serrouya and Associates. Revelstoke and South Slocan, BC.

Skinner DL. 1984. Selection of winter food by beavers at Elk Island National Park. MSc. Thesis. Department of Zoology, University of Alberta. 73 pp.

Steeves, T.K., S.B. Kearney-McGee, M.A. Rubega, C.L. Cink, and C.T. Collins. 2020. Chimney Swift (Chaetura pelagica), version 1.0. In Birds of the World (A. F. Poole, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. Available at: https://doi.org/10.2173/bow.chiswi.01

Stinson, D. W., Watson, J. W. and McAllister, K. R. 2007. Status report for the Bald Eagle. Washington department of fish and wildlife program.

Street, G.M., A.R. Rogers, T. Avgar, and J.M. Fryxell. 2015a. Characterizing demographic parameters across environmental gradients: a case study with Ontario moose (Alces alces). Ecosphere 6:138 Available at: http://dx.doi.org/10.1890/ES1400383.1.

Street, G.M., A.R. Rogers, and J.M. Fryxell. 2015b. Midday temperature variation influences seasonal habitat selection by moose. Journal of Wildlife Management 79:505512.

Temple, D.L., J.M. Chamberlain, and L.M. Conner. 2010. Spatial ecology, survival and cause-specific mortality of gray foxes (Urocyon cinereoargenteus) in a longleaf pine ecosystem. The American Midland Naturalist 163(2): 413-422.

Thomas, V.G., H.G. Lumsden, G. Lane, and K. Intini. 2021. Ontario Trumpeter Swan restoration: current population status and distribution. Ontario Birds, 39(2): 107-115.

Touihri, Moez; Labbe, Julie; Imbeau, Louis & Darveau, Marcel. 2018. North American beaver (Castor canadensis Kuhl) key habitat characteristics: review of the relative effects of geomorphology, food availability and anthropogenic infrastructure. EcoScience 25(1): 9-23. (PDF) North American Beaver (Castor canadensis Kuhl) Key Habitat Characteristics: Review of the Relative Effects of Geomorphology, Food Availability and Anthropogenic Infrastructure (researchgate.net)

Vickery, P.D., B. Zuckerberg, A.L. Jones, W.G. Shriver and A.P. Weik. 2005. Influence of fire and other anthropogenic practices on grassland and shrubland birds in New England. Studies in Avian Biology 30: 139.

Wam HK, Hjeljord O. 2010. Moose summer and winter diets along a large scale gradient of forage availability in southern Norway. European Journal of Wildlife Research 56:745–755.

Watt, D.J., J.P. McCarty, S.W. Kendrick, F.L. Newell, and P. Pyle. 2020. Eastern Wood-Pewee (Contopus virens), version 1.0. In Birds of the World (P. G. Rodewald, Editor). Cornell Lab of Ornithology, Ithaca, NY, USA. Available at: https://doi.org/10.2173/bow.eawpew.01

Wright, K. R. 2016. Count trends for migratory Bald Eagles reveal differences between two populations at a spring site along the Lake Ontario shoreline. PeerJ, 4, e1986. Available online at: https://peerj.com/articles/1986/. Accessed July 6, 2016.

hydroone.com